Remarks/Arguments

The Applicant respectfully request further examination and reconsideration in view of the above amendments and arguments set forth fully below. Claims 1, 8-27, 29-33, 35-127 were previously pending in the present application. Claims 9, 11, 15-18, 20-27, 33, 35-37, 39, 42, 43, 45-127 are withdrawn from consideration. By the above amendments, Claim 1 is amended and new Claim 128 is added. Accordingly, Claims 1, 8, 10, 12-14, 16, 17, 19, 29-32, 38, 40, 41, 44 and 128 are currently pending in this application.

Support for Claim Amendments

The Applicant respectfully submits that the amendments to Claims 1 and 128 are supported by the original disclosure of the present application. Specifically, support is found in Figure 21. Therefore, the Applicant respectfully submits that the amendments to Claims 1 and 128 do not introduce any new matter.

Rejections under 35 U.S.C. §112

Within the Office Action, Claims 1, 8, 10, 12-14, 16, 17, 19, 29-32, 38, 40, 41 and 44 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Specifically, the Examiner states that in Claim 1, it is unclear whether Applicant are claiming the combination of a heat exchanger and heat source or just the heat exchanger alone.

The Applicant has amended Claim 1 to no longer recite the limitation "wherein the fluid is distributed such that at least one interface hot spot region in the heat source is selectively cooled." Reference to a heat source in Claim 1 describes the structural limitations of the heat exchanger, specifically that the conducting portion of the heat exchanger is configured to be in contact with a heat source along a plane. The Applicant respectfully submits that Claim 1 does not claim a heat source and the heat exchanger. This is further evidenced by the newly added dependent Claim 128, which recites "further comprising a heat source including at least one interface hot spot region, wherein the fluid is distributed to selectively cool the at least one interface hot spot region." Based on the doctrine of claim differentiation that states that two claims in the same patent do not have identical scope, Claim 1 is not limited to a heat source since Claim 128 includes the limitation of a heat source. It is clear from these amendments to the claims that Claim 1 claims the heat exchanger alone. For at least these reasons, the Applicant

respectfully request that the rejection of Claims 1, 8, 10, 12-14, 16, 17, 19, 29-32, 38, 40, 41 and 44 under 35 U.S.C. §112, second paragraph, be withdrawn.

Within the Office Action, it is also stated that Claims 2 and 10 are now unclear because the "plane" had been deleted from Claim 1 so that the term no longer has any antecedent basis nor sets forth any particular orientation.

The Applicant assumes the Examiner is referring to Claim 8 instead of Claim 2. Since independent Claim 1 has been amended to recite "a conducting portion configured to be in contact with a heat source along a plane," the Applicants respectfully submit that the term now has antecedent basis and sets forth any particular orientation. For at least this reason, the Applicant respectfully requests that the rejection of Claims 8 and 10 under 35 U.S.C. §112, second paragraph, be withdrawn.

Rejections under 35 U.S.C. §103

Within the Office Action, Claims 1, 8, 10, 12-14, 17, 19, 32, 38 and 40 are rejected under 35 U.S.C. §103(a) as obvious over the combined teachings of U.S. Patent No. 5,388,635 to Gruber et al. (hereafter "Gruber") and U.S. Patent No. 5,761,037 to Anderson et al. (hereafter "Anderson"). The Applicant respectfully traverses this rejection for at least the following reasons.

Gruber teaches a cooling hat for transferring heat from a surface or plurality of heat generating components to a flowing fluid. [Gruber, Abstract] The cooling hat has a first tier 216 which includes a supply port and a return port with associated duct segments, a second tier 218 which includes vias and supply channels and return channels, and a third tier 220 which includes a coldsheet with fins and grooves. [Gruber, col. 11, lines 40-44] Specifically, the supply ports, supply ducts, supply channels, supply capillaries, grooves, return capillaries, return channels, return ducts, return ports are each a separate tier. [Gruber, col. 10, lines 3-6] Gruber does not teach that the at least one inlet port channels fluid to fingers which *branch out in a plurality of directions* from the at least one inlet port to the heat exchanger layer via an intermediate layer with a plurality of conduits which extend therethrough. Instead, as clearly illustrated in Figures 2, 3, 8A-B, 12A-C, 17A-C and 22 of Gruber, the supply channels from the support port flow in one direction, while the return channels from the return port flow in the opposite direction. Note that for vertical compactness, the horizontal ports are drawn coplanar with the ducts. [Gruber, col. 15, lines 59-61] It is further stated that the supply ducts are "each oriented in the *same direction*." [Gruber, col. 5, lines 42-44, emphasis added]

Anderson teaches an evaporator for cooling components. [Anderson, Abstract] The evaporator includes a housing for containment of the working fluid. The housing has a surface 104 which is placed in thermal contact with the object body, chip or module to be cooled. The evaporator housing has a heated surface 104 and cap 105. A wicking layer 103 is immediately adjacent to the surface 104. [Anderson, column 3, lines 45-59] The evaporator includes wick member 102 and optional wicking spreader 101. [Anderson, column 3, line 65 through column 4, line 3] The cap 105 is provided with an inlet port 106 and an exhaust port 107 situated along the perimeter of the cap 105. [Anderson, column 4, lines 18-20] The surface 104 is in thermal contact with the chip 30, which is disposed on a printed circuit board 31. [Anderson, column 4, lines 48-52] However, Anderson does not teach that the at least one inlet port channels fluid to fingers which *branch out in a plurality of directions* from the at least one inlet port to the heat exchanger layer via an intermediate layer with a plurality of conduits which extend therethrough.

As such, neither Gruber, Anderson nor their combination teach that the at least one inlet port channels fluid to fingers which *branch out in a plurality of directions* from the at least one inlet port to the heat exchanger layer via an intermediate layer with a plurality of conduits which extend therethrough.

In contrast to Gruber, Anderson and their combination, the present invention is directed to a heat exchanger. The heat exchanger comprises an interface layer that performs thermal exchange with the heat source and is configured to pass fluid from a first side to a second side. [Present Specification, Abstract] The heat exchanger is coupled to a heat source. [Present Specification, page 13, lines 22-23] As illustrated in Figure 21, the manifold layer has a series of channels and ports formed therein. Fingers branch out from the channels and extend completely through the body of the manifold layer in the X and Z-directions. For example, a finger can be parallel or perpendicular to other fingers. Fluid enters the inlet port and flows along the inlet channel to several fingers which branch out from the channel to apply fluid to selected regions in the interface layer. Also as illustrated in Figure 21, the bottom surface of the manifold layer abuts against the top surface of the intermediate layer. Fluid flows freely to and from the intermediate layer and the manifold layer. Specifically, the intermediate layer includes a plurality of conduits which extend therethrough. The inflow conduits direct fluid entering from the manifold layer to the designated interface hot spot regions in the interface layer. Figure 21 also illustrates a microporous structure disposed upon the interface layer. As described above, neither Gruber, Anderson nor their combination teach that the at least one inlet port channels fluid to fingers which *branch out in a plurality of directions* from the at least one inlet port to the heat exchanger layer via an intermediate layer with a plurality of conduits which extend therethrough.

The independent Claim 1 teaches a heat exchanger. The heat exchanger of Claim 1 comprises a body having a conducting portion configured to be in contact with a heat source along a plane, wherein the conducting portion is configured to conducts heat from the heat source to a heat exchanging layer configured within the body, the body including at least one inlet port and at least one outlet port, wherein the at least one inlet port channels fluid to fingers which *branch out in a plurality of directions* from the at least one inlet port to the heat exchanging layer via an intermediate layer with a plurality of conduits which extend therethrough, the heat exchanging layer includes a porous microstructure disposed thereon and is configured to distribute the fluid and to pass the distributed fluid therethrough. As described above, neither Gruber, Anderson nor their combination teach that the at least one inlet port channels fluid to fingers which *branch out in a plurality of directions* from the at least one inlet port to the heat exchanger layer via an intermediate layer with a plurality of conduits which extend therethrough. For at least this reason, the independent Claim 1 is allowable over Gruber, Anderson and their combination.

Claims 8, 10, 12-14, 17, 19, 32, 38 and 40 are dependent on the independent Claim 1. As discussed above, the independent Claim 1 is allowable over Gruber, Anderson and their combination. Accordingly, Claims 8, 10, 12-14, 17, 19, 32, 38 and 40 are all also allowable as being dependent upon an allowable base claim.

Within the Office Action, Claims 1, 8, 10, 12-14, 17, 19, 32, 38 and 40 are rejected under 35 U.S.C. §103(a) as obvious over the combined teachings of Gruber/Anderson and further in view of either U.S. Patent No. 5,983,997 to Hou (hereafter "Hou") or U.S. Patent No. 5,239,200 to Messina et al. (hereafter "Messina"). The Applicant respectfully traverses this rejection for at least the following reasons.

As described above, Gruber, Anderson and their combination do not teach that the at least one inlet port channels fluid to fingers which *branch out in a plurality of directions* from the at least one inlet port to the heat exchanger layer via an intermediate layer with a plurality of conduits which extend therethrough.

Hou teaches a system for cooling electronic components including a cold plate. The cold plate has a channel through which a fluid coolant is transported, a plurality of bosses each receiving a heat generating component, and a plurality of fin structures. Each fin structure contacts a boss and has a fin inlet and a fin outlet in fluid communication with a section of the channel for supplying the area around the boss with coolant and cooling the component seated on the boss. Sections of the channel in the serpentine path further transport the coolant in opposite

directions, thus enhancing heat transfer and temperature equilibration across the cold plate. [Hou, Abstract] Hou does not teach that the at least one inlet port channels fluid to fingers which *branch out in a plurality of directions* from the at least one inlet port to the heat exchanger layer via an intermediate layer with a plurality of conduits which extend therethrough. Instead, the heat generating component of Hou is secured to each boss by drilling and tapping the boss and providing a screw or other fastening member through the component. [Hou, col. 4, lines 21-24] Accordingly, neither Gruber, Anderson, Hou, nor their combination teach that the at least one inlet port channels fluid to fingers which *branch out in a plurality of directions* from the at least one inlet port to the heat exchanger layer via an intermediate layer with a plurality of conduits which extend therethrough.

Messina teaches an apparatus for cooling an array of integrated circuit chips mounted on a substrate. [Messina, Abstract] Disposed in a cooling relationship over the array of chips is a heat transfer module. A cold plate is disposed in a cooling relationship over heat transfer module. [Messina, column 3, lines 14-20] To provide a sealed enclosure for the coolant, an overhead cover member is disposed over cooling plate. [Messina, column 3, lines 42-45] An inlet and outlet are provided through cover surface on opposite ends of the cover to permit entry and exit of the coolant fluid. [Messina, column 4, lines 3-6] Messina does not teach that the at least one inlet port channels fluid to fingers which *branch out in a plurality of directions* from the at least one inlet port to the heat exchanger layer via an intermediate layer with a plurality of conduits which extend therethrough. Instead, the baffles of the cover and the channels of the cooling plate to direct and permit coolant flow, as illustrated in Figure 1. The two piece construction of the present invention are bolted or otherwise fastened to each other through interior fastener openings in the cooling plate and cover. [Messina, col. 4, lines 14-18] Accordingly, neither Gruber, Anderson, Messina, nor their combination teach that the at least one inlet port channels fluid to fingers which *branch out in a plurality of directions* from the at least one inlet port to the heat exchanger layer via an intermediate layer with a plurality of conduits which extend therethrough.

As discussed above, neither Gruber, Anderson, Hou, nor their combination teach that the at least one inlet port channels fluid to fingers which *branch out in a plurality of directions* from the at least one inlet port to the heat exchanger layer via an intermediate layer with a plurality of conduits which extend therethrough. Also as discussed above, neither Gruber, Anderson, Messina, nor their combination teach that the at least one inlet port channels fluid to fingers which *branch out in a plurality of directions* from the at least one inlet port to the heat exchanger layer via an intermediate layer with a plurality of conduits which extend therethrough. For at

least these reasons, the independent Claim 1 is allowable over the teachings of Gruber; Anderson; Hou; the combination of Gruber, Anderson and Hou; Messina; and the combination of Gruber, Anderson and Messina.

Claims 8, 10, 12-14, 17, 19, 32, 38 and 40 are dependent on the independent Claim 1. As discussed above, the independent Claim 1 is allowable over Gruber; Anderson; Hou; the combination of Gruber, Anderson and Hou; Messina; and the combination of Gruber, Anderson and Messina. Accordingly, Claims 8, 10, 12, 13, 14, 17, 19, 32, 38 and 40 are all also allowable as being dependent upon an allowable base claim.

Within the Office Action, Claim 16 is rejected under 35 U.S.C. §103(a) as unpatentable over Gruber/Anderson alone or in view of Hou or Messina as applied to Claim 1, and further in view of U.S. Patent No. 4,758,926 to Herrell (hereafter "Herrell"). The Applicant respectfully traverses this rejection for at least the following reasons.

Claim 16 is dependent on the independent Claim 1. As discussed above, the independent Claim 1 is allowable over Gruber; Anderson; Hou; the combination of Gruber, Anderson and Hou; Messina; and the combination of Gruber, Anderson and Messina. Accordingly, Claim 16 is also allowable as being dependent upon an allowable base claim.

Within the Office Action, Claims 29-32 are rejected under 35 U.S.C. §103(a) as unpatentable over Gruber/Anderson alone or in view of Hou or Messina as applied to Claim 1, and further in view of U.S. Patent No. 6,680,044 to Tonkovich (hereafter "Tonkovich"). The Applicant respectfully traverses this rejection for at least the following reasons.

Claims 29-32 are dependent on the independent Claim 1. As discussed above, the independent Claim 1 is allowable over Gruber; Anderson; Hou; the combination of Gruber, Anderson and Hou; Messina; and the combination of Gruber, Anderson and Messina. Accordingly, Claims 29-32 are all also allowable as being dependent upon an allowable base claim.

Within the Office Action, Claims 1, 8, 10, 12-14, 16, 17, 19, 29-32, 38 and 40 are rejected under 35 U.S.C. §103(a) as obvious over the combined teachings of Gruber in view of the Jiang et al. article "Thermal-Hydraulic performance of small scale micro-channel and porous-media heat exchangers" (hereafter "Jiang"). The Applicant respectfully traverses this rejection for at least the following reasons.

As described above, Gruber does not teach that the at least one inlet port channels fluid to fingers which *branch out in a plurality of directions* from the at least one inlet port to the heat exchanger layer via an intermediate layer with a plurality of conduits which extend therethrough.

In Jiang, the flow and heat transfer performances of a micro-channel heat-exchanger and a micro-porous heat-exchanger are theoretically and experimentally investigated and evaluated. The experimental apparatus consisted of water tanks, pumps, a test section, regulator valves, accurate manometers, instrumentation to measure temperatures, an electric heater system and filters. The test section contained either a micro-channel heat-exchanger or a micro-porous heat-exchanger. [Jiang, page 1041] The heat-exchangers are fabricated from stacked cooper plates. To manufacture the micro-channel heat-exchanger, the stack is heated until soldering tin is melted. To manufacture the micro-porous heat-exchanger, the stack is sintered together with small copper particles. The heat-exchangers are packaged and sealed. [Jiang, page 1041-1042] No where in Jiang does Jiang teach fingers that *branch out in a plurality of directions* from the at least one inlet port to the heat exchanger layer via an intermediate layer with a plurality of conduits which extend therethrough.

Accordingly, neither Gruber, Jiang nor their combination teach fingers that *branch out in a plurality of directions* from the at least one inlet port to the heat exchanger layer via an intermediate layer with a plurality of conduits which extend therethrough. For at least this reason, the independent Claim 1 is allowable over Gruber, Jiang and their combination.

Claims 8, 10, 12-14, 16, 17, 19, 29-32, 38 and 40 are dependent on the independent Claim 1. As discussed above, the independent Claim 1 is allowable over Gruber, Jiang and their combination. Accordingly, Claims 8, 10, 12-14, 16, 17, 19, 29-32, 38 and 40 are all also allowable as being dependent upon an allowable base claim.

Within the Office Action, Claims 1, 8, 10, 12-14, 16, 17, 19, 29, 30-32, 38 and 40 are rejected under 35 U.S.C. §103(a) as being unpatentable over Gruber in view of U.S. Patent No. 4,896,719 to O'Neill (hereafter "O'Neill") and Tonkovich. The Applicant respectfully traverses this rejection for at least the following reasons.

As described above, Gruber does not teach that the at least one inlet port channels fluid to fingers which *branch out in a plurality of directions* from the at least one inlet port to the heat exchanger layer via an intermediate layer with a plurality of conduits which extend therethrough.

O'Neill teaches a plenum in combination with a heat exchange panel and a panel structure having a large number of closely spaced orifices of equal size. [O'Neill, Abstract] A conduit provides fluid to the panel structure. [O'Neill, column 2, lines 8-10] The fluid is forced

into the heat exchanging panel through orifices and out of the heat exchanging panel through orifices. [O'Neill, col. 3, lines 13-18] O'Neill does not teach that at least one inlet port channels fluid to fingers which *branch out in a plurality of directions* from the at least one inlet port to the heat exchanging layer via an intermediate layer with a plurality of conduits which extend therethrough. Instead, O'Neill teaches that a heat exchange medium directed into the plenum through conduit 16 travels up through orifices 18 to panel 14, then returns from 14 to exhaust down through the plenum via tubes 23. [O'Neill, col. 2, lines 61-67]

Tonkovich teaches chemical reactors and reaction chambers and methods for conducting chemical reactions having gas phase reactants. [Tonkovich, Abstract] Tonkovich does not disclose a heat exchanging system. As such, Tonkovich does not teach that at least one inlet port channels fluid to fingers which *branch out in a plurality of directions* from the at least one inlet port to the heat exchanging layer via an intermediate layer with a plurality of conduits which extend therethrough.

Accordingly, neither Gruber, O'Neill, Tonkovich nor their combination teach fingers that *branch out in a plurality of directions* from the at least one inlet port. For at least this reason, the independent Claim 1 is allowable over the teachings of Gruber, O'Neill, Jiang and their combination.

Claims 8, 10, 12-14, 16, 17, 19, 29, 30-32, 38 and 40 are dependent on the independent Claim 1. As discussed above, the independent Claim 1 is allowable over Gruber, O'Neill, Jiang and their combination. Accordingly, Claims 8, 10, 12-14, 16, 17, 19, 29, 30-32, 38 and 40 are all also allowable as being dependent upon an allowable base claim.

Within the Office Action, Claims 41 and 44 are rejected under 35 U.S.C. §103(a) as being unpatentable over any of the prior art reference as applied to Claim 1, and further in view of US Patent No. 5,918,469 to Cardella (hereafter "Cardella") or International Publication WO 01/25711 A1. The Applicant respectfully traverses this rejection for at least the following reasons.

Claims 41 and 44 are dependent on the independent Claim 1. As discussed above, the independent Claim 1 is allowable. Accordingly, Claims 41 and 44 are all also allowable as being dependent upon an allowable base claim.

New dependent claim

By the above amendments, new dependent Claim 128 has been added. Claim 128 is dependent upon the independent Claim 1. As discussed above, the independent Claim 1 is allowable. Accordingly, Claim 128 is also allowable as being dependent upon an allowable base claim.

The Applicant respectfully requests examination and reconsideration in view of the amendments above and remarks above. Following the above amendments, Claims 1, 8, 10, 12-14, 16, 17, 19, 29-32, 38, 40, 41, 44 and 128 are currently pending. Should the Examiner have any questions or comments, the Examiner is encouraged to call the undersigned at (408) 530-9700 to discuss the same so that any outstanding issues can be expeditiously resolved.

Respectfully submitted,
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